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Wettable Sulfur As A Supplement For Lime-Sulfur, Copper And Zinc Sprays

BY W. L. THOMPSON
ASSISTANT ENTOMOLOGIST
CITRUS EXPERIMENT STATION

During the past few years wettable sulfur has been used extensively as a supplement in various sprays for the control of mites and as an aid in checking scale infestations. It was first used in combination with lime-sulfur to build up the sulfur content of the spray without increasing the toxicity of the spray to the tree. More recently it has been used to very good advantage in combination with copper and zinc sprays. In this article the writer is not going to make definite recommendations for the maximum amounts of wettable sulfur to be used in all types of sprays, since most of the experimental work done to date has dealt with comparisons of spray materials with and without wettable sulfur, rather than comparisons of amounts of wettable sulfur.

In the charts and tables results are shown from only two to four plots in each experiment, the plots being selected which show results where wettable sulfur was used or omitted in the same type of sprays. In all of the following experiments discussed the materials were applied with power sprayers in a commercial way.

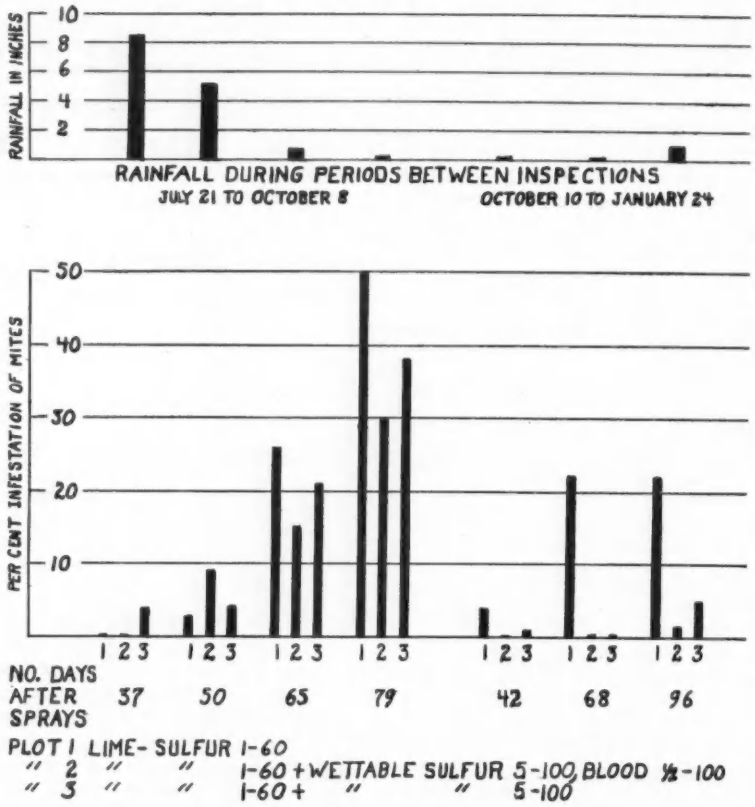
With very few exceptions, the addition of wettable sulfur to lime-sulfur lengthened the period of rust mite control. The results indicate also that the period of control is lengthened more by the addition of wettable sulfur during dry weather than during the rainy season. In chart 1 a comparison can be made of the difference in the length of control with straight lime-sulfur and lime-sulfur plus wettable sulfur during wet and dry periods. Plot 1 received lime-sulfur 1-60; plot 2, lime-sulfur 1-60 plus wettable sulfur 5-100 and blood albumin one-half pound per 100 gallons; plot 3, lime-sulfur 1-60 plus straight wettable sulfur, the wettable sulfur that was used contained over 98 percent sulfur. At the time of the first appliaction, July 21, 1934, the fruit was heavily infested with rust mites.

For the first 50 days there was very little difference in the degree of infestation except that plot 1 had a lower percentage of infested fruit than the other two plots. After 65 days, plots 2 and 3, which received the lime-sulfur-wettable sulfur sprays had a lower percentage of infested fruit than the straight lime-sulfur plot. After 79 days there was 20 percent less infested fruit in plot 2, and 12 percent less in plot 3 than in plot 1, the straight lime-sulfur plot. The actual practical difference was that the added five pounds of wettable sulfur extended the period of commercial control about two weeks. During the period of 79 days, there was a total rainfall of 14.5 inches of which a total of 12 inches fell during the first 50 days.

The second appilcation was made on October 10. At the end of a period of 68 days, there was 22 percent of the fruit infested in plot 1, the straight lime-sulfur plot, and practically none in the other two, and at the end of 96 days there was still 22 percent of the fruit infested in plot 1 and only one and five percent in plots 2 and 3 respectively. There was less than a total of three inches of rainfall during that period. A point to be considered in favor of the lime-sulfur-wettable sulfur spray during the dry period was the low percentage of infestation during the whole period, while in the straight lime-sulfur plot 22 percent of the fruit was infested over a rather long period which means the mites, although not very numerous, were constantly feeding, especially on warm days. It has been demonstrated in several other experiments that wettable sulfur as a supplement to lime-sulfur results in longer periods of control in dry weather than during a rainy season. In an experiment that is still being conducted, one plot received lime-sulfur 1-66 and the adjacent plot re-

ceived lime-sulfur 1-66 plus wettable sulfur 10-100. The first application was made July 9th. At the end of a period of 76 days both plots were infested to about the same degree. During that period there was a total rainfall of 16 inches. The second application was made October 30, and on January 30, or 91 days later, 36 percent of the fruit was infested

CHART I
Periods of Rust Mite Control Obtained With Lime-Sulfur Plus Wettable Sulfur Sprays During Rainy and Dry Seasons


RAINFALL IN INCHES
10
8
6
4
2
RAINFALL DURING PERIODS BETWEEN INSPECTIONS
JULY 21 TO OCTOBER 8
OCTOBER 10 TO JANUARY 24
PER CENT INFESTATION OF MITES
50
40
30
20
10
1 2 3 1 2 3 1 2 3 1 2 3 1 2 3 1 2 3 1 2 3
NO. DAYS AFTER SPRAYS 37 50 65 79 42 68 96
PLOT 1 LIME- SULFUR 1-60
" 2 " " 1-60 + WETTABLE SULFUR 5-100, BLOOD ½-100
" 3 " " 1-60 + " " 5-100

of tests were conducted to determine the maximum amount of wettable sulfur that could be used with lime-sulfur to the best economical advantage for rust mite control. A block of Pineapple orange trees approximately 12 years old was used. In these tests individual trees were considered as plots in replicates of four and arranged in checkerboard fashion so that in the straight lime-sulfur plot and only 16 percent in the lime-sulfur-wettable sulfur plot. During that period there was a total of three inches of rainfall.

The question is often raised as to the amount of wettable sulfur to add to lime-sulfur for rust mite control. In our experimental work the results indicate that five to six pounds of wettable sulfur per 100 gallons is probably the most economical amount to use. In the few tests that we have made along these lines, five pounds per 100 gallons resulted in a much lower percentage of infested fruit than two or three pounds per 100 gallons but the difference was not so great between 5, 10 and 15 pounds per 100 gallons.

During the season of 1936 a series no two trees receiving the came concentration of material were adjacent to each other. The results shown in chart II for individual plots is a naverage of results from four plots which received the same concentration of sprays. A power sprayer equipped with a four-nozzle spray gun was used to apply the sprays. One series of plots received lime-sulfur 1-70, and four other series received lime-sulfur 1-70 plus wettable sulfur, 2, 5, 10 and 15 pounds per 100 gallons, respectively. When the first application was made May 9th the fruit was very heavily infested.

After a period of 33 days from the time of the application there was a much lower percentage of infested fruit in the plots receiving the 10 and 15 pounds of wettable sulfur than in those receiving the two and five pounds, and over 40 percent less than the plot receiving the straight lime-sulfur. At the end of 53 days, the percentage of infestation was about the same in all plots; the addition of the 10 and 15 pounds gave only about three weeks longer protection than the five pounds. It is quite possible that if a whole grove had been sprayed with the more concentrated materials, the increase of mites would not have been quite so rapid since some of those trees which received the 10 and 15 pounds of wettable sulfur were close to the unsprayed trees and to those that became rather heavily infested soon after the application.

The second application was made July 3rd. The higher percentages of wettable sulfur used showed no advantage after a period of 27 days but as the period lengthened, the superiority of the higher concentration became apparent and at the end of both the 53 and 75 day periods, the 5 to 15 pound quantities showed less infestation than was found on the plots receiving the lower concentration. For all practical purposes, however, the five pounds of wettable sulfur was about as effective as 15 pounds per 100 gallons.

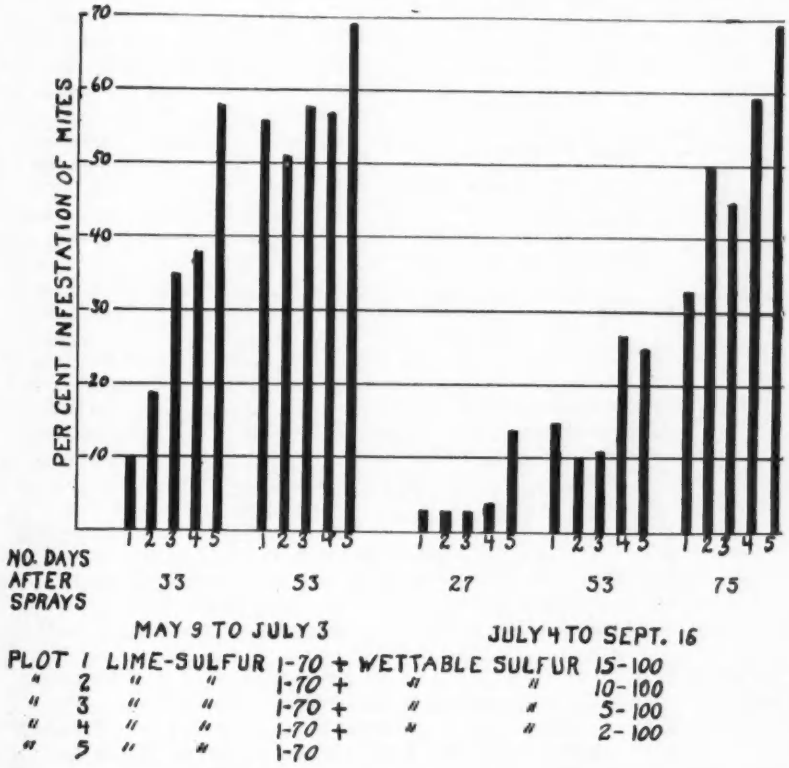
At the present time we have no comparative data as to the maximum amount of wettable sulfur to use with lime-sulfur in obtaining the best results for scale control, but the same holds true as with rust mite control; that is, there has been less increase of purple scale in plots receiving lime-sulfur supplemented with wettable sulfur in amounts varying from two to 10 pounds per 100 gallons than with the straight lime-sulfur solution.

In an experiment conducted during 1934, two plots received bordeaux 1½-1½-50 in April. The follow-up sprays in one plot were three applications of straight lime-sulfur 1-40, 1-60 and 1-50 respectively, and in the other the strength of the lime-sulfur was the same as in the above plot but wettable sulfur was added at the rate of two, four and three pounds per 100 gallons for the respective applications. The final scale count was made in November. In the plot receiving the straight lime-sulfur sprays there was an increase of 36 percent living purple scale per leaf and in the plot receiving the lime-sulfur-wettable sulfur spray, there was a decrease of 56 percent. In two adjacent plots, bordeaux 3-3-50 was applied and fol-

lowed with the same type of sprays as the above plots. In the straight lime-sulfur plot there was an increase of 78 percent, and in the lime-sulfur-wettable sulfur plot there was a decrease of 28 percent. In the check plot where bordeaux 1½-1½-50 was applied without a follow-up spray the one sprayed with the straight lime-sulfur.

One of the important uses of wettable sulfur is its use as a supplement to bordeaux mixture and other copper sprays. Scale crawlers are usually very active about the time melanose sprays are applied and rust

CHART II
Periods of Rust Mite Control Obtained With Varying Amounts of Wettable Sulfur Combined With A Constant Dilution of Lime-Sulfur

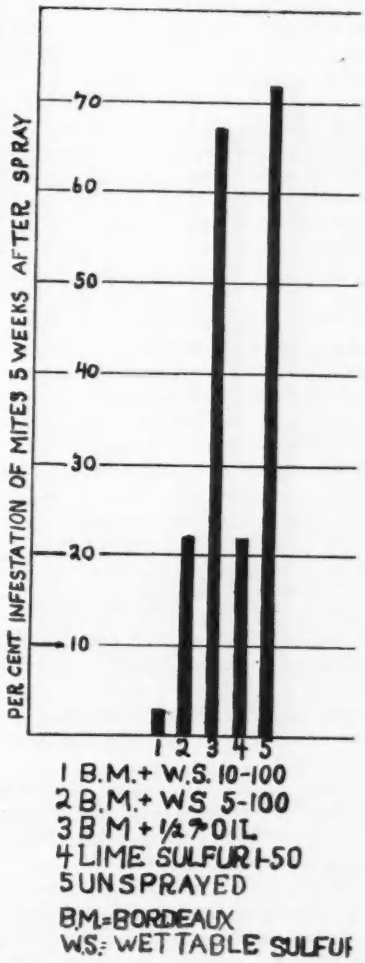


the scale increased 67 percent and in the bordeaux 3-3-50 plot, 167 percent.

One of the most important factors in scale control with sulfur is the importance of applying the spray as soon as possible in the spring, before the rainy season, so the sulfur will not be washed off the trees within a short period of time. Light infestation of scale can also be checked by an application of lime-sulfur supplemented with wettable sulfur if applied in October after the rainy season. In two plots sprayed October 30, 1936, (one, with lime-sulfur 1-66 and the other with the same strength of lime-sulfur but supplemented with wettable sulfur 10 pounds per 100 gallons) there were 20 percent less living purple scale crawlers after two weeks, and 18 percent less after four weeks in the plot sprayed with lime-sulfur-wettable sulfur than in mites are also usually present in large numbers. Bordeaux 1½-1½-50 plus wettable sulfur 5-100 has been as effective for rust mite control as lime-sulfur 1-50, and bordeaux plus wettable sulfur 10-100 was more effective. In chart III are shown the results obtained in a bordeaux-wettable sulfur experiment for rust mite control. This experiment was conducted in a 15 year old Pineapple grove. As shown in the chart, plot 2, which received bordeaux plus wettable sulfur 5-100 and plot 4, which was sprayed with lime-sulfur 1-50, has the same degree of rust mite infestation five weeks after the application. Plot 1, which received bordeaux plus wettable sulfur 10-100, had a very low percentage of infested fruit at that time but the infestation increased rapidly and three weeks later, or a total of eight weeks after the first application, it was necessary to spray for mite control. Bordeaux plus oil emulsion at one-half percent oil concentration gave very poor results and should have been sprayed for mite control two weeks after the bordeaux-oil applications. In an experiment conducted in 1936 in a grapefruit block, a bordeaux-wettable sulfur 10-100 spray applied on three different plots gave commercial control of rust mites from March 31 to June 5, or approximately nine weeks. A plot sprayed with straight bordeaux, and also unsprayed check, were heavily infested by April 15.

The average plots that received bordeaux-wettable sulfur sprays have had less scale insects at the end of

CHART III
Periods of Rust Mite Control With Bordeaux-Wettable Sulfur Sprays



the season than plots sprayed with straight bordeaux mixture, with the same follow-up sprays in all plots. From the results of an experiment

(Continued on page 18)

The Growers' Own Page

This department is devoted to the growers, for their use in giving expression to their views and a discussion of growers' problems. Any grower is welcome to make use of this department for the discussion of topics of interest. The only requirements are that the articles must be on some subject of general interest, must be reasonably short and must be free from personalities. The editor assumes no responsibility for views expressed, nor does publication imply endorsement of the conclusions presented.

Grower Wants To Know

Clermont, Fla., Feb. 5th, 1937
The Citrus Industry,
Dear Editor:

In your February edition, on page 14, I read with something like a shock a statement by one Edward Keenan that grapefruit is being grown in Florida "for less than 10c a box."

I've been living on my 10-acre grove for the past 14 years, since I broke the ground and planted it, and I've stinted and scraped and done a lot of labor work myself and never charged the grove with it and I'll be damned effen I can grow grapefruit anywhere near what Ed Keenand says he, or somebody he knows can.

Please ask the gentleman not to keep his method secret any longer. Tell him to blurt it right out and make himself a boon to all us poor farmers by telling us how to do it. God knows I'll do anything I can to raise grapefruit for "less than 10c a box" effen he only tells me how.

Eddie also says "Why not spend more time in investigating proposed new proration programs which offer means of reducing costs."

I did, Eddie. I have about 8,000 boxes to sell, mine and my neighbors. I burned the gas and went to see the proration man. He said I was to pay him $10.00 for the license, and put up a $100.00 bond, in case I broke my promise and then, migosh! he allowed me to ship 40 boxes a week.

Inasmuch as I couldn't get a packing house to come into my grove and pick only 40 boxes a week, I went home and took my $10 with me to buy something to eat with. I'm gonna need it.

Seems to my dumb mind, this proration plan is a mighty good thing for some folks, but its hard on the little feller, like me.

Yes, I know the boys who are doing the prorating, lifted the ban around Christmas time so the little feller could ship his early fruit, and I thank 'em for it, but effen it was a just thing to lift it once, why ain't it a just thing to keep it lifted?

Yours truly,
E. M. DILLEY.

P. S.—Of course us little fellers must join up with some organization to get the benefits of proration. I did join up with a "co-operative" once and got less for my fruit than if I sold it through the packing houses.

The high salaried guys who sold my fruit are riding around in shiny new autos, but I've got a mortgage on the farm.

More About Production Costs

Frostproof, Fla., Feb. 9, 1937
The Citrus Industry,
Bartow, Fla.,
Gentlemen:

Last month the Editor of this magazine was game enough to print a letter from me in which I said in substance: the future success of the grapefruit industry depended upon the ability of the grower to produce his fruit at a cost of only a few cents a box.

Since that letter was published I am more convinced than ever that the contention is correct. We have seen the result of the intensive advertising campaign of the chain-stores and must note that while they have been of great value in helping us dispose of a large quantity of fruit, they have not, as far as I can see, helped raise the price much.

It is my further contention that we grapefruit growers must face this situation, except in abnormal years, be satisfied with a price of from twenty-five to fifty cents a box to us at the grove. Whether or not the growing of grapefruit is a profitable business depends upon how much below these figures we can grow the fruit.

The large volume to be sold to the public is evident. What price will the public pay, and still absorb this volume? A buyer for one of the largest chain-stores said today that there was no hope the public would ever pay a price for grapefruit that would permit the grower to retain seventy-five or even sixty-five cents per box, because at these figures they would not absorb a volume corresponding to this year's crop. The chain-stores reach from seventy-five to ninety per cent of the possible market.

In speaking of oranges, he said: "Raising the retail-over-the-counter price from thirty-five cents a dozen to fifty cents per dozen would reduce the volume sales by two-thirds." Another authority said he would sell seventy-five per cent more at twenty-five cents a dozen than he could at thirty-five cents. There is all the answer to the price situation that one needs.

There have been many requests (some challenges) to quality the statements I made last month in regard to production costs, so I am offering the following for that reason. The citations are not to exemplify particularly low costs, but selected to average up a collection of groves ranging from part bearing to full bearing. The costs on the full bearing groves are much below the figures given.

Millions of people know how to play baseball, but how many can play a good game? The citrus game can be played by amateurs or by professionals, but, which will win against the consuming public?

TABLE I

No. of Acres	No. of Trees	Kind of Trees
5		Young non-bearing
109	6940	Orange
76	4848	Grapefruit
16	1190	Tangerine
Total 206	12978	

This property is made up five groves and the distance between the two outlying is roughly five miles. The care-taking company in charge of this grove and the Keenan Soil Laboratory have cooperated for six years.

TABLE II

	Boxes Produced		
	'34-'35	'35-'36	'36-'37
Oranges	8837	11291	14430

(Continued on Page 17)

Grove Irrigation....

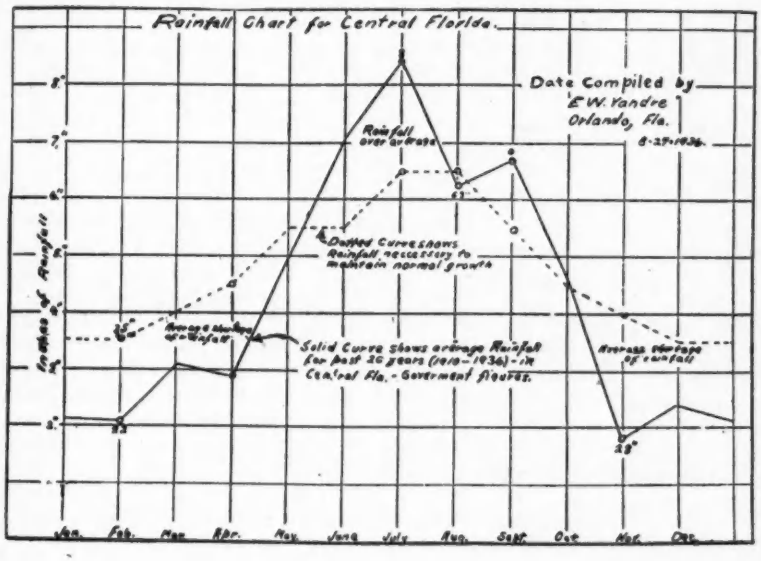
By E. W. Yandre

Grove irrigation is the grower's only insurance that his grove will be profitable, even tho carefully fertilized and cared for.

The fact that it is a necessity is admitted by nearly all the growers but unusually heavy rains for occasional brief periods always do a great deal to hold off action by the growers in preparing themselves for the eventual dry season which always comes.

The accompanying rainfall curve is one that every grower in the State should familiarize himself with. The dotted line shows the amount of rainfall per month that a grove should have to maintain a normal, healthy, growing condition. The solid line, based on Government figures, is the average rainfall per month during the past twenty-six years. The contrast between the lines you will note plainly shows the months of the year that we fall short of the amount of rainfall a grove requires: It illustrates very well the gamble each and every grower takes every year.

We have always had a fair crop of fruit, and a few of the growers have always made money, but that can not be said about the citrus industry in general. The man who can grow his fruit the cheapest can make money almost any year. A careful investigation will prove that the growers, who in the past few years made money consistently, have intelligently used a well designed irrigation system in their groves. A careful study of the rainfall map accompanying this article will enable you to pick, in nearly every case, the months that they irrigate. You will find very few who will not admit that the first season's use invariably paid for the irrigation plant.


Rainfall Chart for Central Florida.
Date Compiled by
E. W. Yandre
Orlando, Fla.
Rainfall over Grove
Dotted Curve shows Rainfall necessary to maintain normal growth
Solid Curve shows average Rainfall for past 26 years (1910–1936) in Central Fla. - Government figures.
Average shortage of rainfall
Inches of Rainfall
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.

Let's look at the curve again. Starting with the months of January, February, March and April, we see how much the 26 year average rainfall is under what we need. That is the answer to the reason why a grove sets a small crop of fruit. Then, after the crop of fruit is set, there's considerable time before the rainy season comes on us. If, during that time, we have drouth, thousands of boxes of fruit the size of walnuts drop to the ground. This represents a total loss to the grower.

This same condition again prevails in the fall of the year. The grower fertilizes, sprays and dusts his grove, and has a good looking crop showing on the trees. With the dry weather that he can anticipate in October and November, the fruit that would have represented a profit, falls to the ground. The canning factories may buy this fruit, but at a price that certainly will not pay the grower any profit.

Every grower should investigate the possibilities of irrigation on their own grove properties. Most of them will be agreeably surprised at the low cost with which it will be possible to equip their groves with adequate irrigation.

Nature has done much for Florida growers by giving them the finest citrus growing climate in the world but the constant demands which citrus trees make upon the soil make it essential that man co-operate with nature in providing proper fertilization.

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You save money by borrowing from us at the low interest rate of 5% per annum and paying cash for your fertilizer, insecticides, etc.

No loan too large or too small for us to handle. Corporations as well as individuals may borrow. All loan applications receive immediate attention.

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"The Citrus Growers Bank"
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P. O. Box 1592 ORLANDO, FLORIDA

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FLORIDA STATE HORTICULTURAL SOCIETY TO CELEBRATE GOLDEN JUBILEE

The Florida State Horticultural Society will celebrate its golden jubilee in Ocala on April 13, 14 and 15, with a pageant depicting the history of the citrus industry in Florida from 1579 down to the present time.

The Florida State Horticultural Society was organized in Ocala on April 12, 1887, by the then leaders in the citrus industry of the state and other horticultural enthusiasts. Very few, indeed, of the original promoters of the society are still with us, but the movement which they inaugurated has gone on to accomplish many of the purposes which impelled the early leaders to foster, promote and sustain the organization.

In every major crisis which has confronted the citrus industry of Florida during the past fifty years, the Florida State Horticultural Society has produced leaders to combat and conquer the emergency. Many of these leaders have passed on. A few remain to support the society and promote its purposes. These few, with those who have later joined them in support of the society, will meet in Ocala next month to celebrate with fitting ceremonies the founding of an institution which has been of inestimable benefit to the citrus industry and to the other horticultural interests of the state for the past half century .

During the past few years the society has been fortunate in having as its secretary Mr. Bayard F. Floyd of Davenport and as its treasurer Mr. Norman Reasoner of Oneco. Recent presidents, now deceased, who rendered valiant service to the society and to the industry, included the late L. B. Skinner of Dunedin and the late John Taylor of Largo.

It is the hope of the present officers and members of the executive committee to make of this coming golden jubilee a fitting tribute to the men whose early efforts made the society possible and whose loyal support served to sustain it during every trying time of its fifty years of existence.

The Florida State Horticultural Society merits the support of every Florida citrus grower and the annual meetings of the society deserve their attendance.

HONESTY IS THE BEST POLICY

In advertising, as in other affairs of life, "honesty is the best policy."

This is clearly demonstrated in the case of the California Fruit Growers Exchange, which has been advertising that California oranges are "22 per cent richer in vitamen C" than Florida oranges. This broad statement, unsupported by facts, went well enough so long as no one in position to do so questioned the statement.

But now comes the Journal of the American Medical Association with the statement that the claim is without foundation in fact. Quoting from a recent report of the laboratory of the Home Economics of the U. S. Department of Agriculture, the Journal finds that there is practically no difference in the vitamen "C" content of Florida and California oranges based on milligrams in cubic centimeters, but that the Florida oranges contain more juice, and hence more vitamen "C" per fruit. The report says that California valencias contain 0.40 milligrams per cubic centimeter, as against 0.45 for Florida valencias; California navels 0.58 as against 0.51 for Florida pineapples. Thus, the Florida valencia is a better producer of vitamen "C" than the California valencia, and while the California navel is slightly higher per cubic centimeter than the Florida pineapple, the greater juice content of the Florida product puts it ahead of the California orange on a per fruit basis.

In the following language the Journal rebukes the California Fruit Growers Exchange for its unfounded and unsupported advertising claims:

"It is apparent that all four varieties of the orange are excellent sources of vitamin C. To direct attention to slight differences in vitamin C. content with the view of capitalizing them is both misleading and contrary to the interests of the public. Such unfortunate publicity tends to defeat the efforts of nutritionists and physisicians to educate the public about the importance of the various fruits and other foods that go to make up our diet. It does not reflect credit on the large California Fruit Growers Exchange."

All of which goes to prove that in advertising as in other matters "honesty is the best policy" and that in the long run, truth will prevail over fiction .

A Texas citrus grower makes a strong plea to have all citrus producing states get together. He is right. When California quits fighting Florida, when Florida quits fighting Texas and when Texas quits fighting both Florida and California, and all get together in a common cause, it will be a great day for the citrus industry.

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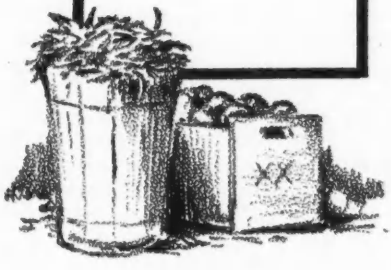

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NACO BRAND

One Grove Superintendent's Experience . . .

A. S. CLARK, TAVARES

On April 1, 1934, I was appointed Superintendent of 125 acres of groves owned by Mr. J. A. Robinson of Oklahoma. The groves are located on Lake Eustis on high hammock soil and Norfolk sand soil and consist of all the commercial varieties. The ages of the trees run from 6-45 years old.

Before I was appointed as Superintendent of these groves, they were handled under the old system of grove management. The production was very low, the condition of the groves was unhealthy, foliage was very light, and the condition of the groves unthrifty. The groves were pruned removing all dead wood.

It was impossible for me to find out what fertilizer practices had been in the past or the amount of plant food applied per tree. The cover crop was very light. In working out a program for this grove with the assistance of our county agent, Clifford R. Hiatt, we made up a budget for the balance of the year 1934. This budget included ample plant food fertilization, supplying the trees with sufficient amount of plant food nitrogen and potash, but practically no phosphate because we know from the old fertilizer system that there had been sufficient amount of phosphate applied in the past to meet the present requirements.

An effort was made to increase the cover crop growth which was accomplished by possibly twice as much cover crop as in any former year. The cover crop was cut with a rotary cutter 3 times the first year, as the result of fertilizing the cover crop. The groves were not disked until late in the fall and it happened to be the year of the severe drouth. A portable irrigation plant was purchased, the same plant being used on both groves. Water was supplied in the grove in sufficient quantities and early enough in the fall to prevent serious damage from the drouth, so that when the freeze came the only portion of the groves that was injured or defoliated by the cold was the portion that I could not reach with my irrigation plant.

The only cultivation carried on in the groves is early in the Spring or late in the fall. This is done merely to prevent fire hazard and put the soil in condition to produce heavier cover crops. I now have cover crops growing on land where none was growing before and as the cover crop has increased supplying an increased amount of rough organic matter to the soil, the trees have improved steadily.

Most of the nitrogen supplied to these trees has been in the form of inorganic nitrates. The potash has been from the muriate source. Most of the phosphate applied has been in the form of rock phosphate. I have no set system of fertilizing but plan to apply the fertilizer three times a year using the highest percentage of nitrogen in the spring, and the summer application is based on quantity of fruit set, condition of trees and climatic conditions. It is my opinion from the experiences on these groves that it is impossible to properly determine a year's program of fertilizing, as far as the materials to use and amounts to apply per tree, because this must be determined by climatic conditions, cover crop and quantity of fruit.

It is my policy to watch every dollar spent and not to spend money on these groves that will not pay dividends. All work that is not a direct benefit to the groves is eliminated. This accounts for low cost of production and the fact that the owner has been able to realize a profit in the last two years, where under the old system, he had not been able to realize a profit. I believe from my experience on this grove, that it is absolutely necessary for grove owners or superintendents to pay strict attention to proper grove management. It is possible to hold production costs down and an economic program as outlined by the Florida Agricultural Extension Service and the county agents has proven successful when carried all the way, and that the system of fertilizing to be used must be based entirely on cover crops grown, and the cultivation program carried out.

I am a member of the Lake County Horticultural Association, and am a member of the Board of Directors and the purchasing committee. The purchasing of my materials through the Horticultural Association has meant a considerable saving to the owner of the grove. Cooperative buying has made it possible for me to purchase my materials at a much lower cost.

As a member of the Board of Directors of the Lake County Horticultural Association, I have become interested in the activities of the Research Committee in cooperation with the county agent, and the Experiment Station on the value of soil amendments, so last fall I laid out a block of groves where zinc sulphate was used on the ground in some blocks and sprayed on other blocks, and copper sulphate was used in combination with zinc. These test blocks are being run on a block of valencia oranges 13 years old. This block showed considerable amount of frenching when started. The blocks where zinc sulphate was sprayed or applied to the ground show very little frenching at the present time; however, the sprayed blocks showed a very rapid recovery and a larger percentage of trees completely recovered. A tangerine block was sprayed last fall and spring completely with zinc sulphate and shows practically 100% recovery. The question in our minds and the purpose of running these tests was to find out the practicability of spraying over the ground applications and the length of time that spraying would be effective. On old trees ground applications of zinc sulphate would cost considerable amount of money so test blocks were started in the old groves to determine if possible if one spraying a year would be sufficient or if an application every other year would be sufficient.

The general condition of the groves in the fall was excellent; in fact, it did not look like the same property.

At the beginning of the next year a good application of nitrate was applied in February and a heavy crop of fruit set. The groves were irrigated in the Spring, which presented the heavy dropping of fruit, holding the vitality of the trees up. Very little phosphate was applied on the groves this year in the formulas used. On one block rock phosphate

was applied as the source of phosphate. The cover crop was heavy during the entire year and was cut four to five times by a rotary cutter. The production of fruit was over double that of the year before, and was the heaviest production that the groves have had for years. The cost per box was very low and net returns to the grower showed a good profit and was the first profit that the groves had brought the owner in nine years. Fruit from these groves was sent to the Florida State Fair at Tampa and helped to bring the blue ribbon back to Lake County.

In the Spring of 1936 an application of nitrate and potash was applied early, followed shortly by irrigation. These groves are not permitted to suffer from drouth, water being supplied whenever the percentage of moisture in the soil runs low.

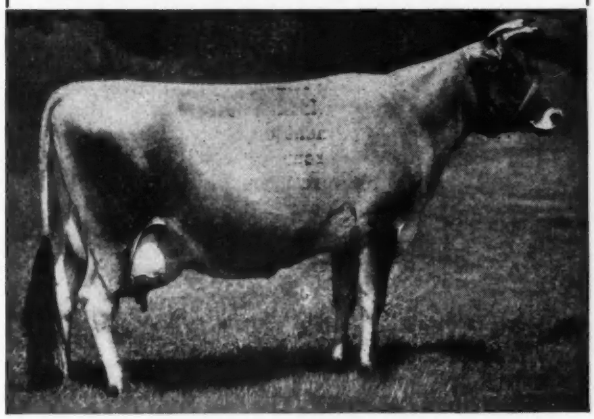
The fertilizing program on this grove has been a one to one ratio or, in other words, an equal amount of plant food, nitrogen and potash for the year, but the total amount of plant food applied is about 40% higher than it was under the old system; thus showing that it is necessary to apply sufficient amount of plant food in order to meet the tree requirements and maintain good physical condition and produce quality and quantity fruit. Even though the amount of plant food applied has been greatly increased over former years, the cost represents approximately 40% less than under the old system.

Realizing that this zinc sulphate could be added to the lime sulphur spray, last fall in November we laid out this old seedling grove. There was a considerable amount of leaf frenching throughout the block. A block was left unsprayed, the balance was sprayed with 5 pounds of zinc, 2½ pounds of lime to 100 gallons of water. This spring we left another block that was sprayed last fall unsprayed, but sprayed the balance of the grove with zinc applied in lime sulphur. The results are as follows: on the unsprayed block where no zinc has been applied at any time the frenching is still just as bad as last fall. There was a heavy dropping of fruit this fall. Fruit did not set as heavy in the spring as on the sprayed block, and there was not as much new growth developing during the year, the leaves are about one-half the size of that of the sprayed blocks. There

(Continued on next page)

"It's pretty hard to beat NATURE"

STOCKWELL'S APRIL POGIS, the only cow in the world twice winner of the President's Cup of the American Jersey Cattle Club. Owned by OWEN MOON, publisher Winston-Salem Journal and Sentinel, owner of Upwey Farms, Woodstock, Vt.



"APRIL"...Empress of the Jerseys

WE present a "close-up" of a world-famous Jersey cow, Stockwell's April Pogis of High Pastures—"April" for short. She made a world's record over all breeds—3217 lbs. butter fat in 3 lactation periods within 3½ years, each under Class A. A. with an average test of 6.46%. No Jersey farm in the world has ever bred, raised and tested her equal.

The pastures are full of Jersey cows—but there's only one "April." She's the empress—a hundred times more valuable than the rank and file of Jerseys—because Mother Nature gave her everything—a perfect natural balance of all the needed elements. So she eclipses all the others.

Natural Chilean Nitrate of Soda is another example of Nature's balance of many different elements. Just as Nature favored "April," she favored Natural Chilean. To this nitrogen fertilizer she gave a natural balance of vital elements—the so-called vital impurities in her own wise blend.

That's why Natural Chilean is more than just quick-acting nitrogen. That's why it is such an effective food for your crops.

Natural Chilean

NITRATE of SODA

NATURAL AS THE GROUND IT COMES FROM

With Vital Elements in Nature's Balance and Blend

RADIO—"UNCLE NATCHEL & SONNY"
FAMOUS CHILEAN CALENDAR CHARACTERS
See announcements of leading Southern Stations

ONE GROVE SUPERINTENDENT'S EXPERIENCE

(Continued from preceding page)

is slight improvement over the groves sprayed last fall and this spring with zinc over the one just sprayed last fall. There is very little difference, however, in the setting of fruit. The leaves are larger in the portion of the grove sprayed twice.

The results obtained are outstanding in the blocks thoroughly sprayed last fall with zinc for correcting frenching, than where zinc was added in the lime sulphur this spring.

There is practically no frenching present and the only frenching that can be noted is in the extreme top of the trees, and it is doubtful whether the spray hit them or not, as these trees are 30 or 35 feet high, and it was difficult to reach the top of the trees with the spraying equipment used. Our plans are to continue this test next year leaving blocks unsprayed to determine if possible how long the zinc spray applied to the foliage will be effective.

I consider these test blocks of great value to me as superintendent of the groves and to the owner because it will show us the most economical method of controlling our zinc deficiencies, and it has certainly proven of value to me as well as the owner of the groves.

In some of the blocks on the grapefruit especially, we had some bronzing occur. Dolomitic limestone was applied last fall on a portion of the block. The trees on which the dolomite was applied showed considerable improvement this fall over that of last year, and because of the results obtained I have applied dolomite over the groves where bronzing occurred.

In summing up my experiences under the new system of grove management, let me say that where a grower will carry a program through all the way and not be fooled by false information handed to him by men who have selfish purposes in mind that there is no question but what results will be obtained and his cost of production lowered anywhere from 40% to 50% as well as production increased and the general condition of his groves improved.

C. D. Kime
Consulting Horticulturist
Grove Advisory Service,
Soil Investigations,
Research
P. O. Box 222
Phone 3489
ORLANDO

Griner's Hotel Helps Popularize Florida Citrus

When Charlie Griner assumed management of the Carling Hotel in Jacksonville that hostelry was already popular among citrus folks in Florida, but Mr. Griner has still further enhanced that prestige during the brief period he has been operating the hotel.

Among the numerous other things which he has done is the establishment of a citrus fruit bar placed in front of the elevators during the breakfast hours in the morning has done much to popularize Florida's outstanding citrus fruits with all visitors to the hotel.

Juice of either oranges or grapefruit is served free of charge to the guests as they come into the lobby on their way to breakfast, and they may drink to their heart's content through the courtesy of the hotel.

Other changes brought about include the change of the name of the hotel which is now known as the Hotel Roosevelt, while the hostelry has been repainted and remodelled throughout.

The dining room patronage has increased to a point, states Mr. Griner where it will be necessary to enlarge that department and to that end the drug store at the right of the entrance has been moved to the other side of the hotel and the work of preparing this room as an addition to the present dining room is already under way.

Numerous other changes and additions either have been made or are being made which will make this popular hotel one of the outstanding places of the sort in the state.

ORLANDO CITRUS PRODUCTION CREDIT ASSOCIATION ELECTS

At a meeting of the Board of Directors of the Orlando Citrus Production Credit Association held in Orlando on February 12, 1937, Philip Marz, Jr., was elected Secretary-Treasurer of the Association to fill the vacancy caused by the resignation of Sam J. Overstreet who is now assistant to the Vice President of the Production Credit Corporation of Columbia, S. C. Mr. Overstreet was present at the meeting and spent several days in the State on business for the Corporation.

Mr. Marz has been connected with the Association since its organization in 1933 and for the past two and one-half years has been assistant Secretary-Treasurer of the Association.

The Orlando Citrus Production Credit Association, known as "The Citrus Growers Bank," is a unit of the Farm Credit Administration and makes porduction loans to citrus growers exclusively in all citrus producing areas of Florida. It is the only association in the Third Land Bank District making one type loans and one of only six such associations in the United States.

The grower who shortchanges his trees the nourishment they should have cannot complain if his trees short-change him in the size and character of the crop they give him at harvest time.

"Faith, Mrs. Casey, you're a woman of wide perception."

"Sure 'tis me own figure and I'll not have ye makin' remarks."

R. O. COLLINS IRON WORKS
TALLAHASSEE, FLORIDA
Chromium Grate Bars
and all types of furnace castings
GEARS, SPROCKETS, PINIONS
all types machinery castings
BRASS, BRONZE AND ALUMINUM CASTINGS
Geo. L. Simonds Co., Winter Haven, Fla., will be pleased to serve you.

The Citrus Industry . . . In Palestine

By Harry Viteles In "Hadar"

(Chapter Two)

Consumption of oranges in the twelve principal European countries in 1934 was 865,000 tons. The consumption of oranges per head in the U. K. was 25 lb per annum. If the average consumption of oranges in these 12 countries reached 15 lb per head, the total supplies would need to be increased by 35%. If consumption reached 20 lb per head, supplies would need to be 75% greater, while if consumption reached the U. K. level, the increasing supplies would be 120%.

Per Capita Orange Consumption (in lbs.) in Specified Countries

U. S. A.	28
U. K.	25
Belgium	17
Holland	16
Switzerland	14
Norway	12
France	11
Sweden	10
Germany	9
Ireland	9
Austria	8
Denmark	7
Czechoslovakia	4
Jugoslavia	1
Roumania	1
Poland	0.9

Imports of Oranges into the United Kingdom

In 1928 the import of oranges into the U. K. during the four months December, January, February and March accounted for 57% of the year's imports, while those for the four months July to October accounted for 8%. In 1934 the four months July to October accounted for 20% of all imports, although over half of the total for the year was still recorded in January to March and in December. The Brazilian and S. African seasons coincide, except that the first Brazilian oranges usually arrive before the end of April, with the heaviest quantities in June, whereas the first S. African oranges do not reach the U. K. before mid-May. In 1935 South African oranges began to come in the market in April, about a month earlier than in 1934, but arrivals up to the end of June were somewhat lighter than during the previous season. Supplies in July and August were heavy, but during September and October they were comparatively light. Californian oranges began to arrive in considerable quantities during May and reach their peak about the end of July. In 1935 the import of summer oranges from the U. S. A. (April to November) amounted to twice as

(Continued on page 19)

Imports of Oranges in to Specified Countries in 1934 (in Tons)

Country	Imported Quantity	Principal Sources
U. K.	520,000	Spain about 50%, Palestine 25%, S. Africa and Brazil each 12%.
Germany	261,000	Spain 70%, Palestine 18%, Italy 10%.
France	265,000	Spain 90%.
Sweden	34,000	Spain 54% and Italy 32%.
Norway	22,000	Spain 75% (Grapefruit and Lemons included)
Denmark	11,000	Spain 70% and Italy 5% (Grapefruit and Lemons included).

. . . AND NOW FOR THE NEXT CROP!

Building an economical and resultful fertilization program for your grove calls for planning ahead. Often a new crop is in the making before the old is off the trees. Now is the time to ask the Gulf Field Man in your section to go over your crop problems — and suggest a month-by-month fertilization schedule for 1937. The Gulf Brands of Fertilizer he recommends will save you money in the long run.

For Everything that Grows in Florida—use GULF Brands of FERTILIZER

Friendly Fertilizers Keyed to your Soil

THE GULF FERTILIZER COMPANY
36th Street, South of East Broadway, Tampa, Florida

Grapefruit Juice To Be Bought By AAA In Surplus Removal Program

Canners of grapefruit juice in Florida and Texas are being requested by the Agricultural Adjustment Administration to make offers to sell grapefruit juice for relief distribution to the states through the Federal Surplus Commodities Corporation, it was announced Feb. 1.

An initial purchase of 200,000 cases of the juice was sought from canners in Florida and 100,000 cases from canners in Texas for the two weeks beginning February 8.

Similar offers will be requested at intervals of two weeks in accordance with the need of the situation. Offers in connection with the current program are expected to aggregate approximately 1,500,000 cases, it was stated.

Jesse W. Tapp, assistant administrator of the Adgricultural Adjustment Administration, said the grapefruit juice purchase program is one of several measures put into effect to assist grapefruit growers in meeting a serious surplus situation.

The Agricultural Adjustment Administration, he said, already has in effect a program for buying fresh fruit for relief distribution. The canned grapefruit juice purchases and the fresh fruit buying program supplement the efforts which Florida growers and shippers are making under a federal marketing agreement and order in adjusting fresh fruit shipments more nearly in keeping with market requirements so that returns to growers may be improved. The buying of canned grapefruit juice is designed to increase domestic consumption by diverting surplus grapefruit from the normal channels of trade and making the product available to the needy and unemployed.

Canners supplying the Agricultural Adjustment Administration with grapefruit juice will be required to pay growers a tree price of 31 cents per standard field box in Florida and a tree price of $7.50 a ton in Texas. These prices are comparable, and are on the same basis on which fresh fruit is being bought by the Agricultural Adjustment Administration in the two areas.

Each case of canned grapefruit juice in the initial purchase is to contain two dozen No. 2 cans. The cans are to be labeled by the canners with labels which will be furnished them, and the lids of the cans are to be embossed to read "FOR RELIEF—NOT TO BE SOLD" and with a code symbol which will identify the canner and the date of canning.

If canners can satisfactorily show that they are unable to complete deliveries of grapefruit juice under their contracts for the reason that they are unable to purchase from growers grapefruit in accordance with provisions of the program, adjustments will be made for these canners in the time of delivery and in the quantities of grapefruit juice to be delivered.

Mr. Tapp said that additional purchases of canned grapefruit juice are contemplated in the Florida and Texas areas, and are to be made as conditions warrant. He said purchases of fresh fruit for relief distribution which started during the last week in October are to be continued. To date, approximately 790,000 boxes of grapefruit in Florida and 337,000 boxes of Texas fruit have been bought by the Agricultural Adjustment Administration for relief use throughout the country. Much of this fruit now being bought is being distributed in the flood stricken areas of the Mississippi and Ohio River valleys.

Surplus agricultural commodities bought by the Agricultural Adjustment Administration are turned over to the Federal Surplus Commodities Corporation for relief distribution to the States. The canned grapefruit juice is to be distributed for relief use after the fresh grapefruit shipping season is over.

Production of grapefruit this year is placed at 28,383,000 boxes, compared with 18,516,000 boxes a year ago. This year's crop is almost double the 5-year 1928-1932, average production, and has caused an acute surplus situation resulting in serious marketing difficulties and low prices for growers.

Through the marketing agremeent program which is supplemented by fresh fruit and canned juice purchases by the Agricultural Adjustment Administration the industry is being enabled to improve marketing conditions for this season's record-breaking crop and develop a more effective program for meeting the more acute marketing difficulties to accompany further increases in production expected within the next half dozen years.

Doctor: "Is the night nurse giving you proper attention?"

Vic: "Not exactly, but I'm perfectly satisfied."

IRRIGATION AND SPRAY EQUIPMENT

STATIONARY OR PORTABLE SYSTEMS
GENUINE AMES LOCK SEAM SLIP JOINT PIPE

THERMOMETERS — H-B Self Registering and Alarm Types

THE CAMERON AND BARKLEY CO.
Citrus Packing and Canning Supplies
Cambar Service
TAMPA, FLORIDA
Since 1865
Send For Illustrated Folder

GROWER'S OWN PAGE

(Continued from Page 8)

Grapefruit	14580	21020	25550
Tangerine	670	3094	6000
Total	24087	35405	45980

Partly estimated—Considered very conservative.

Table 3 gives the operating cost for the three years and covers all items exclusive of overhead. The figures given for the fiscal year 1935-36 are broken down in Table 4. The figures covering the year 1936-37 are based on what has been spent in the last half of 1936 and the budget for the first half of 1937.

TABLE III

Cost Per Box

	'34-35	'35-'36	'36-'37
Oranges	.570	.411	.348
Grapefruit	.241	.154	.137
Tangerine	1.105	.221	.123
Av. all fruit	.386	.241	.201

The actual direct costs for the fiscal year (August to August), 1935-36 were as per Table 4.

TABLE IV

Material	Costs
Fertilizer	$3,649.85
Spraying	2,519.46
Pruning and Hoeing	966.96
Cultivating	322.02
Irrigating	595.08
Miscellaneous	718.39
Total	$8,771.76

At the time of writing this a record of the grade of fruit is not available, but, it is in order to say the quality of the 1936-37 grapefruit is 100% over that of 1935-36 and the packing house records show that for 1936-37, — 95% of what has been shipped ran No. 1 and No. 2. Out of forty some odd thousand boxes, from groves controlled by this company and handled in a similar way, and including fruit from the above groves, 83% of the fruit graded U. S. No. 1.

Fertilizing elements for the above groves were derived from materials varying from year to year as soil tests indicated their requirements.

I trust these figures will be of interest and that they will illustrate the trend of modern practice, and it is through this means that there will be a gradual reduction in the cost of growing citrus, because through these modern programs there will be a reduction in pruning, spraying and irrigating costs.

Yours truly,
EDWARD KEENAN,
Keenan Soil Laboratory.

Is Fertilizer Expensive?

Fertilizer prices are relatively lower than those of other commodities; fertilizer has improved in quality; its use results in a 250 per cent annual profit on the investment; and the purchase takes but a very small part of the farmer's income. These are conclusions reached in an examination of fetilizer prices which appears in the January-February issue of The Fertilizer Review, published by the National Fertilizer Association.

The cost of fertilizer is measured by three yardsticks—its price in relation to other commodities, its value to the farmer, and his ability to pay for it. The price of a commodity stated in dollars and cents fails to indicate if it is cheap or expensive. In order to determine the relative expensiveness of fertilizer it should be examined in comparison with these related factors.

According to price studies made by the United States Department of Agriculture, the farmer's pre-war dollar is worth today only 79 cents, as the commodities he buys are now selling on the average at prices 27 per cent higher than in the pre-war period. In contrast to this, when the farmer buys fertilizer his pre-war dollar is worth $1.04. Of all the 11 commodities or groups of commodities bought by farmers for which the Department compiles price figures, only one is now selling below the 1910-1914 level, and that one is fertilizer.

From March 1933, when prices were at their low point, until now, prices received by farmers for their products have increased 129 percent. During this same period prices paid by them for all commodities bought have gone up 27 per cent, but fertilizer has risen only 5 per cent. Another study from a governmental source shows that since 1880 the ratio of the price of fertilizer to all commodity prices has been falling.

Not only has fertilizer been getting cheaper in relation to other commodities but its value has also been increasing and its quality improving. The average ton of complete fertilizer today is not the same commodity as was the average ton 50 years ago or 10 years ago. In 1920 mixed fertilizer used in the United States contained on the average of 278 pounds of plant food in each ton. At the present time the average content is about 365 pounds, an increase of 31 per cent. In addition to this increase in plant food content the mechanical condition has been improved facilitating application and increasing efficiency.

Cost of fertilizer is not a big item of expense to the farmer when compared with his income or with other expenditures.

FLORIDA DOLOMITE

(A Natural Carbonate of Magnesium and Calcium)

During the past week a prominent fruit buyer made the following unsolicited statement: "That FLORIDA DOLOMITE of yours most certainly is a wonderful product, and gives very positive and visible results." He continued, "I have just bought Mr. 'X's' fruit and can tell to the row where your Dolomite was used. Not only is the tree in a more thrifty condition, but the quality of the fruit will warrant 25c more per box where the Dolomite was used".

Plan now for Quality Fruit next season. Ask your regular fertilizer representative for FLORIDA DOLOMITE or write

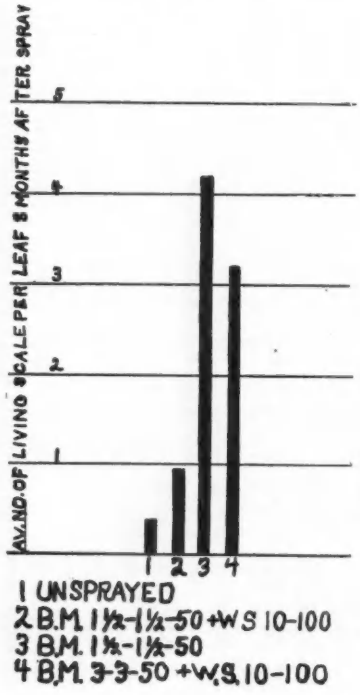
Florida Dolomite Company
Pembroke, Florida

WETTABLE SULFUR AS A SUPPLEMENT FOR LIME-SULFUR, COPPER AND ZINC SPRAYS

(Continued from page 7)

conducted in 1936, a comparison can be made of the increase of purple scale after an application of bordeaux with and without wettable sulfur. The plots received only the melanose or bordeaux application with no follow-up sprays during the remainder of the season. When the application was made, March 31, there was a very light infestation of purple scale on all of the trees, or an average of only .08 living scale per leaf for the four plots. The plots were sprayed with the following materials: Plot 1, no treatment of any kind during the season; plot 2, bordeaux 1½-1½-50 plus wettable sulfur 10-100; plot 3, bordeaux 1½-1½-50 plus spreader 1-200; plot 4, bordeaux 3-3-50 plus wettable sulfur 10-100. A scale count was made from each plot before the bordeaux application and another count was made in December, or approximately eight months after the application.

CHART IV
Purple Scale Build-up Following Bordeaux Sprays



As shown in chart IV, plot 2, which received bordeaux 1½-1½-50 plus wettable sulfur 10-100 had an average of only .97 living scale per leaf, whereas plot 3, which received the same strength of bordeaux as plot 2, but with wettable sulfur omitted, had an average of 4.2 scale per leaf. In plot 4, which received the full strength bordeaux plus wettable sulfur, there were 3.2 scale per leaf, or one less than in plot 3. The increase of scale in the untreated plot was very slight. From the results of the above experiment and others of like nature, the increase of scale should not be feared, if the wettable sulfur is added to the bordeaux, or other copper sprays, and the proper precautions taken in the follow-up sprays. The results also indicate what is likely to happen after bordeaux sprays if the proper follow-up programs are neglected.

In a recent experiment which was in cooperation with Mr. Walter Reuther of the Citrus Experiment Station, different forms of zinc compounds were used in combination with lime-sulfur and wettable sulfur. In order to give the program and materials a severe test in regard to purple scale increase, three applications were made on a block of 15 year old Pineapple trees. The trees were in very good condition having more inside foliage than the average Pineapple tree grown in the ridge section. Only the results obtained with zinc sulfate with the sulfur combinations are noted here.

In Table I are shown the materials used, dilutions, and the results obtained for the control of purple scale and rust mites.

TABLE I
Purple Scale and Rust Mite Control With Combination of Zinc Sulfate and Sulfur Sprays

Plot No.	Materials and Dilutions	Purple Scale Av. Living per Leaf Before Treatment	Purple Scale Av. Living per Leaf After Treatment	Purple Scale Av. Increase or Decrease for Season	Rust Mites Av. % of Infested Fields at end of Periods between Applications Apr. 7 to May 19	May 19 to June 29	June 29 to Oct. 1
1	Zinc Sulfate, Lime 4-2-100 Lime-Sulfur 2-100	.20	.78	+.59	31	28	33
2	Zinc Sulfate, Lime 4-2-100 Wettable Sulfur 10-100	.78	.21	-.57	31	20	21
3	Lime-Sulfur 2-100	.65	.15	-.50	16	30	39
4	Check	.74	.75	+.01	75	85	62

As shown in Table I, there was a slight decrease in the number of purple scale in plot 2 which received the zinc sulfate-hydrated lime-wettable sulfur spray while there was a slight increase of scale in plot 1 which received the zinc-lime-lime-sulfur spray. The percentage of rust mite infestation was lower in the plot where wettable sulfur was added. On an average, purple scale and rust mite control was slightly better in plots where the zinc sprays were supplemented with wettable sulfur 10-100 than where they were supplemented with lime-sulfur 1-50.

During the past five years of experimental work we have never observed an increase in fruit burning when wettable sulfur was used in amounts varying from 2 to 15 pounds per 100 gallons with lime-sulfur. In two different experiments, there was slightly less burn on fruit in plots sprayed with lime-sulfur plus wettable sulfur compared to the straight lime-sulfur plots, but on the average there is little or no difference. An application of an oil emulsion, one percent oil concentration, plus wettable sulfur 5-100 caused severe burning on grapefruit leaves and fruit. In adjacent plots, little or no burn was caused by the straight oil emulsion.

In conclusion, wettable sulfur has been found to be a safe and effective supplement for lime-sulfur, bordeaux mixture, and other copper sprays. and for the recommended zinc sprays. Wettable sulfur at the rate of five to six pounds per 100 gallons is probably the most economical amount to add to lime-sulfur for rust mite control. A larger amount may result in a little longer period of protection but the added cost of the material may offset that advantage unless the period is long enough to reduce the number of applications necessary during a season. If scale control is to be considered, the amount of wettable sulfur may be increased to advantage, especially if a weak solution of lime-sulfur is used. The same recommendations hold true in copper and zinc sprays; that is, if wettable sulfur is added for rust mite control, five pounds per 100 gallons is sufficient, but if scale crawlers are pre-

sent, the amount should be increased to 10 pounds.

The results of experiments discussed in this article are more or less typical of results obtained in various other experiments conducted during the past five years, but rather wide variations have occurred. The control of rust mites and scale insects varies considerably because of weather conditions, location of the grove, type of materials used, and thoroughness of application; and this causes variations in experimental results.

THE CITRUS INDUSTRY IN PALESTINE

(Continued from page 15)

much as during 1934, namely 1 505,000 and 734,000 cases respectively. Less than 20% arrived in April and May, as compared with nearly 30% during the same months in 1934. The import of Spanish oranges continues throughout June and sometimes July, but in 1935 arrivals from the end of March onward were lighter than in 1933 and 1934, namely 525,000 half cases as compared with 1,413,000 in 1933, and 1,293,000 in 1934. Palestine, therefore, has the advantage of not having to compete with Empire grown oranges, which are exempt from import duty. Furthermore, Palestine oranges have to pay only 10% ad valorem duty throughout the season, except April, while Brazil, U. S. A. and other non-Empire countries pay 10% ad valorem plus 3/6 per cwt. (i.e., an additional duty of about 2/7 per case).

The following table (summarized from a Table in Weekly Fruit Intelligence Notes of the 16.10.35) on the Imports of Oranges into the U. K. during the last four seasons, 1931/32 — 1934/35, shows;

(a) slight decrease in total imports;

(b) Spanish oranges decrease while Palestine oranges increase both absolutely and relatively to the total supply. During the 1931/32 season Spain sent to the U. K. about 29%, while in 1933/34 it sent only 25.5% of its commercial orange crop.

(c) Imports from Brazil in November and December 1934 amounted to 131,000 and 14 000 cwts. respectively out of total imports of 449,000 and 1,795,000 cwts. During January—April 1934 the imports from Brazil amounted to 5,000 cwts, and from the U. S. A. to 59,000 out of a total 4,383 000 cwts. during these four months.

Imports of Citrus into Canada

Canada having placed the U. S. A. on the free list, this fact may be an advantage rather than a disadvantage to Palestine, depending almost entirely on the question of freight rates. If the freight rates from Florida and California to Canadian markets less than those to the U. K., plus the import duty (of 3-6 per case of grapefruit) throughout the year, then California and Florida may ship more grapefruit to Canada. This diversion from the U. K. markets to the Canadian markets will also depend on the extent, to which increased consumption of grapefruit in Canada will keep pace with the surplus of grapefruit in the U. S. A. which will be availabl efor export. Oranges are not affected very much because, as pointed out previously, the U. S. A. ship very small quantities of winter oranges to Europe and, from all information available, such expots probably will not increase. Until now Palestine's citrus exports to Canada have been insignificant, both absolutely and relatively, both as regards total exports from Palestine as well as total imports into Canada. During the last three seasons, 1932-33, 1933-34 and 1934-35, Palestine shipped to Canada (figures submitted by Fruit Inspection Service) 34,134; 39,303 and 35,845 cases of oranges and 724, 768 and 247 cases of grapefruit respectively.

The following table shows that (a) the import of oranges into Canada during 1932-1934 was practically stable; (b) the imports from the U. S. A. are on the decrease; (c) the U. S. A. are the supplier; (d) imports of grapefruit have decreased from about 476,000 cases during 1932 to nearly 435,000 cases in 1934 and, as in the case of oranges the U. S. A. are the supplier.

(To Be Continued)

Were you a good little girl at Sunday School today?

Yes, the teacher offered me a big plate of money and I said, "No, thank you."

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Bud Mutations In Horticultural Crops

A. D. SHAMEL & C. S. POMEROY
Bureau of Plant Industry, U. S. Department of Agriculture,
Riverside, California
In "The Journal of Heredity'

Descriptions of many striking bud mutations in deciduous and citrus fruits have been presented by the authors in the Journal of Heredity and in other publications during the past few years.

This paper presents a summary of the information which the authors have been able to compile regarding bud mutations in fruit and potato varieties. A partial bibliography of publications on this subject is appended for the use of students and other interested persons.

In many of the instances recorded in this paper the mutations have been personally observed and studied by the writers, while in the other cases reliable reports by competent observers have been accepted. It is not practicable to present as complete descriptions as might be desired, but readers interested in obtaining more complete information concerning particular cases may do so through correspondence.

There is no longer much question as to the commercial importance of bud mutations in many of the horticultural crops that are propagated vegetatively. This statement applies not only to those variations which are superior to the parent forms in one or more characteristics, but also to those which for any reason are less desirable for commercial use than the parent forms. The search for and study of bud mutations has been rather intensive during the past 20 or 25 years, and many new forms have been discovered. Some of these are now of considerable commercial importance and most of them are of scientific interest. The purpose of this article is to call attention to the progress that has been made in accumulating data regarding the occurence of these mutations, particularly those found during recent years.

Early Reference to Bud Mutations

The earliest recorded fruit bud mutations that have come to the attention of the writers were reported by Peter Collinson in a letter to Linnaeus April 3, 1741. He told of a russet apple produced on a green-fruited tree, and of peaches and nectarines produced on the same tree. In another letter written over twenty years later (September 17, 1765) Collinson describes another peach mutation—a nectarine growing on the same twig with a peach. Six additional instances of nectarines produced on peach trees were reported to the Horticultural Society of London by R. A. Salisbury on May 3, 1808.

On April 4, 1815, Thomas Andrew Knight, addressing the Horticultural Society of London, declared his belief "that many varieties of fruit which are supposed to be totally distinct have been propagated from branches of the same original tree; and that few, if any, varieties of fruit can, with strict propriety, be called permanent, when propagated by buds or grafts." He then reported a Yellow Magnum Bonum plum in his garden which had a branch bearing red fruit exactly similar to the Red Magnum Bonums. A May Duke cherry tree in his garden produced on one branch late-ripening, oblong fruit of inferior quality. He also stated that he believed the Auche pear, a certain type of the St. Germain pear, and the large Swan's Egg plum were bud mutations of similar character .

TABLE 1.—Summary of bud mutations in certain tree fruits as recorded prior to May 25, 1936.

Variant forms	Apple	Pear	Peach	Plum	Cherry	Grape
Fruit Variations						
More color	254	2	3	6	6	1
Less color	21	2	10	8	..	6
Striped fruit	5	47	..	..	..	2
Russeted fruit	26	17	..	..	..	1
Larger fruit	30	13	1	3	4	45
Smaller fruit	2	..	..	..	..	11
Flattened fruit	6	1	..	..	..	..
Oblong or long	5	1	..	..	..	..
Other abnormal shapes	20	3	1	1	4	..
Early maturity	3	3	41	2	3	4
Late maturity	3	1	19	2	38	1
Early bearing	3	..	..	..	..	..
Unproductive	..	..	3	..	48	1
Seedless	2	..	..	..	..	2
Nectarines	..	..	27	..	..	..
Other abnormal fruit	8	..	..	..	..	4
Foliage Variations						
Variegated	1	2	9	1	6	4
Willow leaf	..	..	5	..	1	..
Cut leaf	..	..	2	..	1	3
Other abnormal foliage	2	1	18	1	..	1
Flower variants	..	..	2	..	7	..
Other misc. variants			5	2	2	1
Totals	391	93	146	26	120	87
Grand total						863

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The earliest reference to a fruit variation in the United States which has been found is that of Cole who in 1849 reported on the Red Russet apple, which he said "seems to be a cross between the Baldwin and the Roxbury Russet." An article in his New England Farmer in 1850 suggested the sport origin of the variety and another article by Sanborn in the same periodical in December, 1852, gave a detailed description of its origin as a bud sport.

Gaudichaud reported to the Paris Academy of Science in 1852 an apple tree which produced several sorts of fruits, and in 1859 Oberdieck described a Red Gravenstein mutant. A few years later other French and German writers referred to additional Red Gravenstein variations.

In studying the rapid increases in the number of bud mutations in fruit varieties recorded in recent years it is found that the first summary of such forms, presented by Carriere in 1856, listed 35 definite foliage and fruit variants, with banana, plum, and potato mentioned as having produced "several" varitations. Fawcett reports that the Gros Michel banana, which is the principal variety of commerce today, was of bud variation origin. Darwin in 1868 recording bud mutations that were mostly found in England, listed 46 leaf and fruit variations in horticultural fruits, 23

of which were instances of nectarines that developed on peach trees.

Cramer's list of bud mutations published in 1907 gives 56 instances in fruit crops and states that all the banana and pineapple varieties were of bud origin.

Powell in 1898, Beach in 1905 and Dorcey in 1917 recorded a considerable additional number of fruit mutants, but in spite of thsee and the earlier records of such forms the almost universal opinion of horticulturists up to about twenty-five years ago. was that fruit varieties perpetuated by asexual propagation were entirely stable and unchangeable and that new forms could arise only from seedlings.

In 1909 the senior author began studies on bud variation in citrus fruits. These attracted immediate attention because of the large number of variants that were found. The frequency of the occurence of these forms led to a widespread belief that the citrus fruits must be especially subject to bud variation and different in this respect from the common deciduous fruits.

However, the announcement in 1922 of the high price paid for the red mutation of the Delicious apple introduced as the Starking, gave a strong incentive to fruit growers and others to search for variations from which they might also secure a rich reward. In the next few years many interesting and valuable fruit variations were reported, mostly in apples cherries, peaches, and pears, with fewer numbers of apricots, berries dates, figs, grapes, pineapples, plums and prunes.

J. T. Bregger, who has been particularly active in the collection of data relative to apple bud sports, recorded 125 red bud mutations in apples in 1930. A list of apple mutations prepared August 15, 1931, by Shamel and Pomeroy showed 143 red variants and 30 variations in other characters. A similar list prepared November 1, 1932, by Shamel, Pomeroy and Bregger presented 221 red variants and 100 other forms. In table 1, 254 red apple variants are recorded as of May 25, 1936, with 137 additional apple variations.

The first plant patent was issued August 18, 1931. From that date to May 12, 1936, 177 plant patents were issued. Fifty-two of these covered new fruits and of this number 17, or 32.7 per cent, were of bud origin.

The number of bud mutations that have been recorded in apples, pears, peaches, plums, cherries and grapes is summarized in Table 1, by the character of their fruit and foliage variations. Similarly, bud mutations in the Washington Navel and Valencia oranges, in lemons, grapefruit and other citrus varieties are presented in Table 2. Bud mutations in many other fruits that have received less study from this standpoint, and in potatoes, are given in Table 3.

(Concluded next issue)

TABLE 2. — Summary of the most important types of bud mutations observed in citrus fruits. Several of the numbers given are conservative estimates, as no detailed records have been kept of the many variants observed..

Variant forms	Washington navel orange	Valencia orange	Lemon	Grapefruit	Other varieties
Australian types	150	....	....	....	....
Unproductive	10	25	50	5	2
Early	2			1	41
Corrougated	200	500	100	10	17
Pear-shaped	10	5	25	....	....
Long	20	50	....	....	....
Flattened	5	20	....	....	5
Striped	5	10	5	....	....
Brown spotted	2	....	....	....	....
Yellow	30	5	....	....	3
Reddish-orange	2	....	....	....	1
Dual	1	1	....	....	....
Coarse	25	40	5	....	....
Smooth	10	10	....	....	1
No navel	25	....	....	....	....
Persistent-style	2	....	....	....	....
Small	10	50	....	....	....
Seedless	....	1	....	1	2
Pink flesh	....	....	1	15	....
Orange flesh	....	....	1	....	....
Dry flesh	10	1	....	....	1
Misc.	10	15	10	....	5
Foliage variations					
Variegated	20	40	5	....	5
Willow-leaf	2	10	....	....	10
Misshapen-leaf		1	....	....	....
Rolled-leaf	2	....	....	....	....
Totals	551	786	202	32	93
Grand Total					1,664

TABLE 3. Summary of recorded bud mutations in certain fruits and vegetables, most of which have as yet received but little study.

Variant forms	Fruit Variations	Foliage Variations
Almond	1	1
Apricot	3	5
Banana	12	
Blackberry & dewberry	2	28
Currant	7	6
Date	3	....
Fig	7	2
Gooseberry	6	1
Jujube	....	1
Olive	1	....
Persimmon	2	....
Pineapple	25	4
Raspberry	3	....
Walnut	2	....
Strawberry	1	1
Irish Potato	91	3
Sweet Potato	15	1
Totals	181	53
Grand Total		234

A Correction

Frostproof, Fla., Feb. 10, 1937.

Mr. S. L. Frisbie, Editor,
The Citrus Industry,
Bartow, Fla.,

Dear Mr. Frisbie:

In reference to your letter from me published in the February issue I note that the last three lines in next to the last paragraph on page 14 were slightly twisted and the word "proration" should have been "production" making the sentence: "Why not spend more time in investigating proposed new production programs . . . " whereas the sentence reads "new proration programs."

With kindest personal regards, I am,

Yours very truly,
EDWARD KEENAN.

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More Americans have failed in Cuba than in any other citrus country anywhere — and the fault is their's, 100 per cent. Come here and work, let politics alone, forget rum, attend strictly to your own business and you will be a happy winner. Am a resident forty years. A climate of 10 to 15 degrees lower in summer than any part of Florida or the Mid-West of the U. S. I am not selling out, just offering surplus property. No cold, no storms, no fertilizer. Health to spare. You simply cannot lose. I also have a small property, 40 acres with 1200 Valencias, good water, rich soil, beginning to bear. $1000 will swing this. A bargain. Time on balance at 6 per cent.

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WANTED—Man with from ten thousand to twenty thousand dollars to grow an entirely new orange for the U. S. markets. Cheap lands, no cold, plenty water, no fertilizer. A world beater in an orange. Patented.—Address, Buen Negocio, Gaveta-1, Holguin, Cuba.

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CITRUS NURSERY TREES, standard and new varieties on Cleopatra and Sour. Priced from 30c up. Grand Island Nurseries, Eustis, Fla.

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PUREBRED PULLETS FOR SALE—White Leghorns and Anconas ready to ship. Barred Rocks and R. I. Reds shortly. Several hundred yearling White Leghorn hens now laying 70%. Write or wire for prices. C. A. Norman, Dr. 1440, Knoxville, Tenn.

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SCENIC HIGHWAY NURSERIES has a large stock of early and late grapefruit and oranges. One, two and three year buds. This nursery has been operated since 1883 by G. H. Gibbons, Waverly, Fla.

NEW COMMERCIAL lemon for Florida, the Perrine; proven. All residents need yard trees, keeping Florida money at home. Booking orders for budded stock for Winter delivery. DeSoto Nurseries, DeSoto City, Fla.

CITRUS SEEDLINGS, all root stock varieties. $10.00 per 1000 up. Grand Island Nurseries, Eustis, Fla.

SEED—Rough lemon, sour orange, cleopatra. New crop from type true parent trees. Also thrifty seedlings. DeSoto Nurseries, DeSoto City, Florida.

BUDDED trees new Florida commercial lemon, proven, thin skinned, juicy, scab immune. Also rough lemon, sour orange and Cleopatra seed and liningout seedlings. DeSoto Nurseries, DeSoto City, Fla.

SEEDS—ROUGH LEMON, SOUR ORANGE, CLEOPATRA. Pure, fresh, good germination. Also seedlings lineout size. De Soto Nurseries, DeSoto City, Fla.

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(Keenan Soil Laboratory)

Frostproof, Florida.

Statement Of . . . Growers And Shippers League Of Florida

In a prepared statement distributed by the Association of American Railroads announcing conclusions reached by the Chief Traffic Officers of the carriers at conference held in Chicago, February 12th, to consider the industry's request for a temporary emergency reduction in rates on grapefruit, as an aid in marketing a super-bumper crop, the railroads say:

"It was finally concluded unanimously as to territories and unanimously as to individual railroad companies, that it would be impracticable for the railroads to make the reduction sought."

The conclusions of the railroads to the contrary nothwithstanding, we make the following observations and pertinent comments, viz:

1. Citrus production is the most dependable and greatest provider of potential profitable rail tonnage of any fruit grown in the United States and grapefruit is a very important part of citrus production. On the whole, citrus is perhaps the most dependable and prolific producer of profitable potential rail traffic of any other single perishable commodity grown, yet the Chief Traffic Officers of the railroads declined to assist the industry in an emergency calling for greatly lowered freight rates to market a super-bumper crop, unprecedented in the annals of citrus history.

2. The present basic Florida citrus interstate rate structure has outlived its usefulness. It was predicated on the volume of citrus production and shipments prior to the crop year of 1925, at a time when neither boats nor trucks had entered the picture as strong competitive transportation factors. Citrus production has more than doubled in volume since the Interstate Commerce Commission designed and the railroads promulgated the present basic rate structure as representing maximum reasonable rates for interstate transportation of citrus from Florida. Moreover, practically all other factors contributing to citrus production, picking, packing and marketing have changed materially since the present rate structure was considered by the Commission and made effective by the carriers. In other words, the structure cannot be considered otherwise than archaic and too inflexible in operation to meet the needs and demands of a fast expanding industry in the light of the changed conditions within and surrounding the industry, and last but not least, competitve transportation itself.

3. Grapefruit and other citrus should be considered in a different category from hardy perishables and general merchandise freight in rail commodity rate structures. There should be more flexibility therein for quick change as an aid to maximum crop marketing through perishable merchandising channels and meeting competitive conditions as they arise. Citrus must be marketed as it matures. It cannot be left on the trees or stored for any great length of time without almost prohibitive risk of costly deterioration, whereas, in the case of surplus supplies of semi-perishables and other merchandise, storage and suspended distribution may be economically and successfully practiced for almost indefinite periods.

4. The voluntary adoption of the industry's proposal would not have entailed the shouldering of any out-of-pocket expense by the carriers on the present crop from Florida. Moreover, it seems apparent that the carriers must have overlooked the many millions of dollars realized in profits from the transportation of citrus and supplies for the industry in past seasons and given little thought to the future; else they could not have so completely denied the industry's request in the premises.

5. Furthermore, in point of good policy they at least could have expressed a willingness or shown some inclinations to cooperate with the Traffice Departments of the citrus industry in woking out a satisfactory adjustment of rail rates for the future in line with suggestion made at the Washington hearing. Their failure or refusal to do so is further evidence that they have no desire to engage in negotiations with the industry for a friendly solution of the problem.

6. It is submitted that the loss to the rails of most of that Florida citrus tonnage which has moved in ever increasing amounts by boats and trucks in recent years, and which is referred to by the carriers in their conclusions, is further evidence of what is believed to be the unprogressive, selfish and general misguided policies of some of the railroad systems in their dealings with the industry.

7. Wherefore, as the Florida citrus industry can no longer rely upon the railroads to provide rates adjusted to meet the needs of its expansion requirements, this League is cooperating with the Florida Citrus Commission to remedy the situation by making available for adoption by the industry at no great distant date, a practical, workable plan for more intensive use of other forms of transportation at rates, package estimated weights and load minima; also time schedules, frequency of service and other citrus transportation requisites that should be generally helpful and satisfactory to the industry.

Dated at Orlando, Florida, March 3, 1937.

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Thos. D. Guthrie, Traffic Manager.

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The satisfaction which growers have expressed over this success is highly gratifying to us. We believe these results again demonstrate what our organization can do to help solve growers' problems.

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